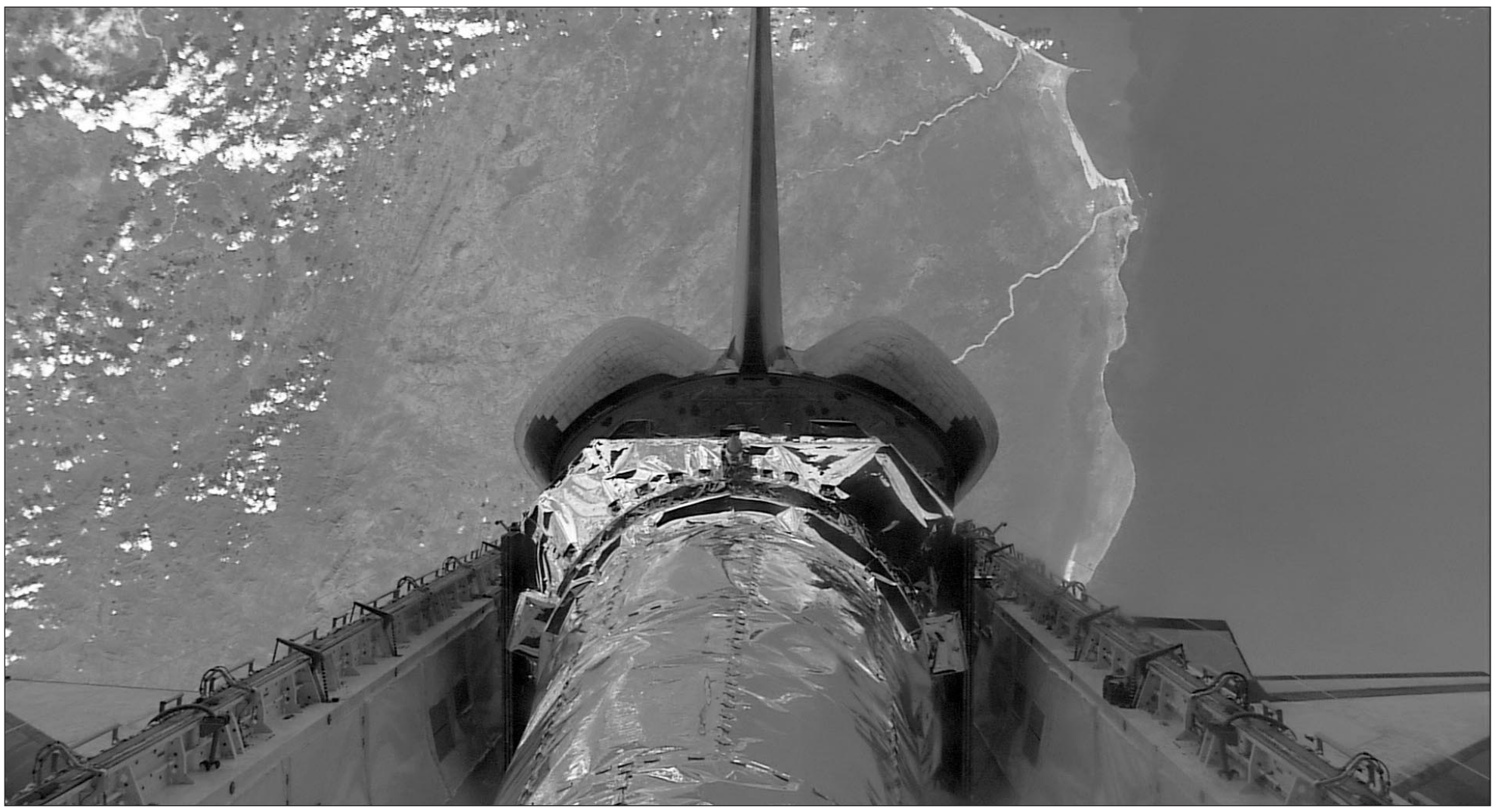

HDTV's remarkable clarity and crispness will help scientists gather more information from its improved Earth imaging. Some scientists say the current standard video equipment appears "out of focus" when compared to HDTV views such as the one above.

Sharper image comes to JSC:

HDTV brings new images of space

By Nicole Cloutier

High definition television, also known as HDTV, is changing the way we see space.

As a detailed test objective (DTO) on STS-93, an HDTV camcorder (on loan from Sony as part of a Space Act Agreement) was used to capture the Chandra deployment on tape, Earth observations and in-cabin activity. HDTV camcorders were at KSC to cover *Columbia*'s launch and landing, activities during the mission in MCC, and the STS-93 pre-mission training. Although the improved quality of the footage was remarkable in itself, when image analysts were able to use post-flight footage to help identify hydrogen leak sites on the booster engine bells, HDTV's capabilities really came to light.

"It's amazing," said Mike Lee, Hernandez Engineering scientist with the Image Science and Analysis Group. As part of the DTO, Lee compared post-flight images in HDTV format with NTSC (our normal television format) footage but the outcome surpassed his expectations. "The HDTV imaging is so much more impressive – there's really no comparison. It's almost better than being there yourself seeing it with the naked eye because HDTV allows you to zoom in on minute details."

HDTV is a subset of digital television (DTV) and brings with it a new level of broadcast efficiency and quality. The U.S. DTV standard can broadcast multiple video channels with improved quality in the same bandwidth now occupied by the current analog NTSC format. The improved technology is demonstrated by remarkable image clarity, several times better than the analog systems commonly used today.

"We're able to achieve significant improvement in image quality not previously possible," said Doug Holland, JSC's lead project engineer for HDTV. "This technology will enable us to fulfill new mission objectives and allow us to improve our abilities to perform existing mission requirements."

For STS-93, the primary objectives were to test and demonstrate the HDTV format as an engineering and inspection tool as well as its capability to perform Earth observations. To that end, meticulous detail and picture crispness was critical. A large portion of the success of HDTV on STS-93 was due to the exceptional performance by the two crewmembers assigned to HDTV, Cady Coleman and Jeff Ashby.

NASA JSC Photo S99-05085

In preparation for an STS-93 DTO, astronauts Jeff Ashby, pilot, and Cady Coleman, mission specialist, train with a high-definition television camcorder.

This crew took a personal interest in making the most out of this flight project.

"After seeing HDTV, NTSC footage almost looks like it's out of focus," said Eric Nielsen, Video Digital Analysis Systems (VDAS) Lab manager also with Hernandez Engineering. Nielsen works with Lee, where they regularly assess launch and landing video for anomalies. "The difference is like night and day. Looking at HDTV, you see can see details of objects that are not visible in the NTSC images."

Analog systems tend to lose quality when they are transmitted or recorded, while digital systems, such as HDTV, can be recorded or transmitted without loss in quality.

"Each time you record from an analog NTSC source onto any of the common analog tape formats such as VHS, you lose signal quality and integrity," said Holland. "After a few generations, the quality has degraded to an unusable level, especially for our needs. But with DTV formats like HDTV, you can copy as many generations as you desire with the last being as clear as the original."

The team had an unexpected opportunity to demonstrate HDTV's value with STS-93. Shortly after liftoff, a hydrogen leak developed in one engine bell. Design redundancy stabilized the situation in flight but engineers on the ground were anxious for the opportunity to examine the hardware. As part of every mission, a video crew does a walk-around survey of the orbiter immediately after landing. When *Columbia* landed, a recording also was made with an HDTV video camera, including documentation of the suspect leak area. Copies of the footage were made available to Lee and Nielsen here in Houston for analysis.

"The HDTV footage really helped us on this flight during the post-landing walk around," said Nielsen. "Our primary interest during the walk around was to have a view of the engine bell showing the area of the suspect leak. The NTSC views showed the discoloration and spray pattern caused by the leak, but it was not until we viewed the HDTV images that three perforations became visible. These were the first views of the damage provided to JSC."

In addition to helping organizations who rely on video, HDTV is also very promising for regular users of still film photography. Julie Robinson, Lockheed Martin senior scientist in the Office of Earth Sciences, also depends on visuals from space to conduct her job analyzing Earth images. Her team collects photos from every shuttle mission which are used to map natural environments and to study changes in land use such as deforestation and urban sprawl.

"Film cameras have been the standard for our purposes," said Robinson. "Use of video hasn't even been an option until now."

Robinson says the lack of resolution with standard NTSC video cameras eliminates the possibility of using standard video products for her studies. However, they conducted side-by-side assessments of the HDTV footage with standard photos from STS-93 and are excited about the results.

"Although film still provides better resolution and larger fields-of-view, HDTV presents a useful complement to film, and offers some advantages," Robinson added.

One characteristic they noticed immediately with HDTV was color accuracy. Film is manufactured and developed to respond to sunlight on Earth, but sunlight in the orbital environment has different characteristics. Photographic images come back off-color and usually have to be corrected in the lab. HDTV captures the color true-to-life.